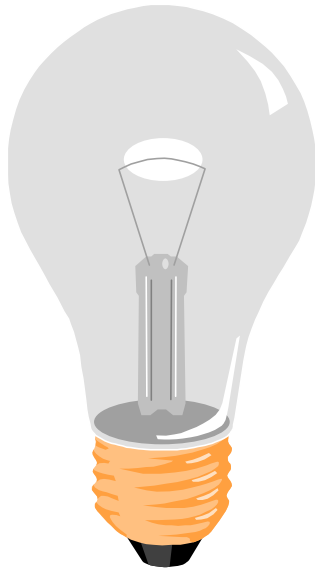


# **Standing by in Central Europe**

## **A survey of Hungarian, Romanian and Bulgarian residences**



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APR 29 2002

# Content



- ⌘ **Background: Appliance energy efficiency in CEE**
- ⌘ **Aims of research**
- ⌘ **Methods and definition**
- ⌘ **Results**
- ⌘ **Standby-related emissions and savings potentials**
- ⌘ **Comparison to previous estimates**
- ⌘ **Conclusions**


# Introduction



- ⌘ Energy intensities in Central and Eastern Europe (CEE) are among the highest in the world
- ⌘ In addition, due to lifting of energy price subsidies paying bills represents a major burden to residents
- ⌘ Thus, improving energy efficiency is a high priority
- ⌘ Appliance markets are in dynamic changes, thus appliance-related en. eff. policies have special relevance
- ⌘ To date, the extent of standby losses is poorly understood in CEE; only some estimates exist (Eg. EIA for Hungary)



# Background: appliance energy efficiency in CEE



- ⌘ Post-socialist appliance stock legacy: few, mainly basic home appliances (fridge, TV, washing machine), but often inefficient
- ⌘ Stocks of several “luxury” appliances (microwave, VCR, IT equipment, etc.) are starting to penetrate households, or are far from saturation levels
- ⌘ stocks of other old appliances are rapidly turning over to “new”, Western varieties (TV, fridge, phones, etc.)
- ⌘ dynamic market turnover and unsaturated appliance penetrations create unique window of opportunity for leap-frogging:
- ⌘ if progressive appliance policies introduced, stocks could reach efficiency levels higher than OECD averages.

# Aims of research



- ⌘ Understand the scale of standby power losses and related emissions in CEE countries
- ⌘ estimate electricity and carbon savings potentials

# Methods



- ⌘ **Standby power of appliances in 99 households in Bulgaria, Romania and Hungary have been measured**
- ⌘ **The field measurement of standby power was conducted with watt meter - “Energy-Cost-Checker EKM 265” ( $\pm 1\% \pm 3$ digit)**
- ⌘ **Each household appliance susceptible of having standby power consumption was measured**
- ⌘ **The standby power per household was calculated by summing the individual usage weighted standby consumption of each appliance (Ross&Maier 2000)**
- ⌘ **The national level estimations are based on extrapolations**

# Definition

$$\text{Standby power (Watt)} = (W \times T)/24$$

W = the minimum power that the appliances draw when connected to the mains (Ross&Meier 2000)

T = time during which the appliance is in standby mode  
(24 - T<sub>active mode</sub> - T<sub>off mode</sub>)



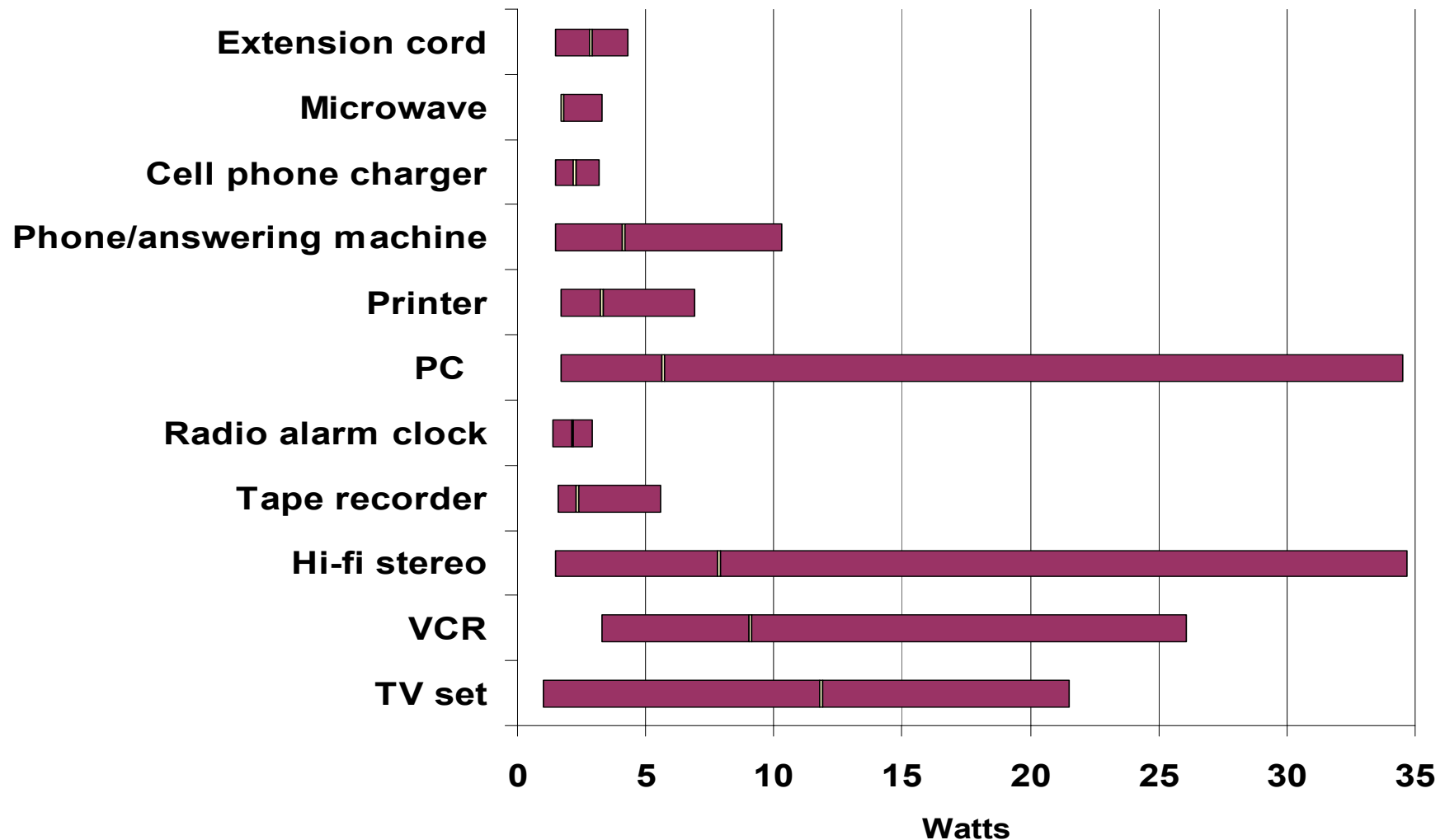
# RESULTS



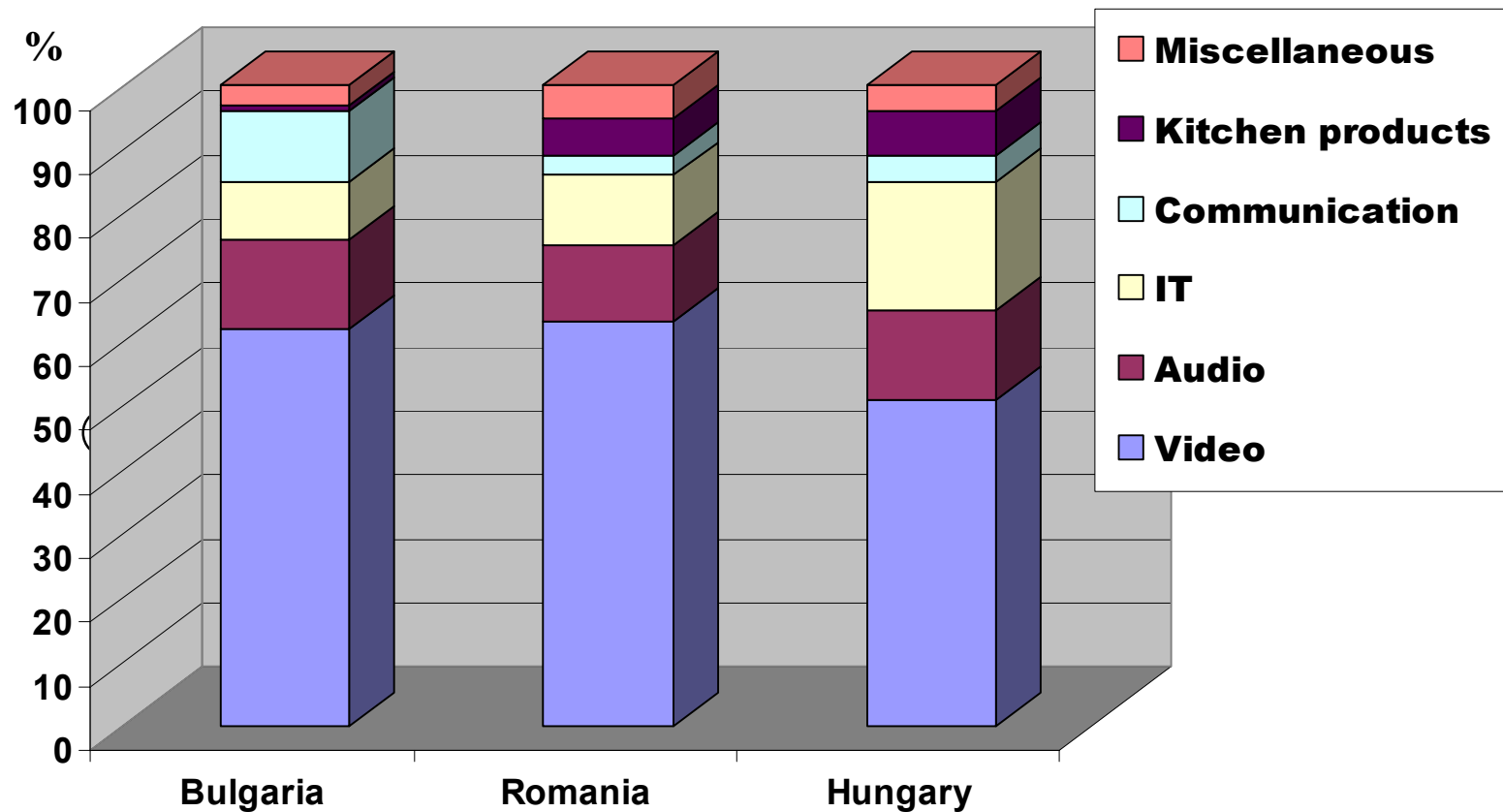
# Standby consumption and average number of appliances per household in CEE region

Appliance	Number of appliances measured	Average number of appliances per HH	Average standby consumption (Wh/d)
<b>Video</b>			
TV set	123	1.24	164
VCR	55	0.56	217
<b>Audio</b>			
Hi-fi stereo	43	0.43	191
Tape recorder	15	0.16	51
Radio alarm clock	23	0.23	47
<b>IT</b>			
PC	38	0.38	147
Printer	9	0.09	59
<b>Communication</b>			
Phone/answering machine	34	0.34	83
Cell phone charger	14	0.14	37
<b>Kitchen products</b>			
Microwave	13	0.13	38
<b>Miscellaneous</b>			
Extension cord	15	0.15	53
<b>Total</b>	<b>382</b>		<b>1087</b>

# Standby power ranges (minimum, median and maximum) of appliance types in CEE region based on the results in the three countries



# Contribution of appliance categories to the total standby consumption in %(Wh/d)



## Standby power loads per household

Country	Average number of appliances with standby features in HH	Average standby power per HH* (W)	Average standby consumption per HH (Wh/d)
Bulgaria	5	33	789
Romania	3	14	340
Hungary	4	30	709
CEE	4	26	613

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\*Usage weighted

# Estimation of energy demand and CO<sub>2</sub> emissions from residential standby power

Country	Number of HH (millions of units)	Average standby power (W/home)	Total standby power demand (MW)	Total standby energy (TWh/yr)	Total national electricity consumption 1998 <sup>1</sup> (TWh/yr)	Resid. Standby as % of national electricity (%)	CO <sub>2</sub> emission ratio <sup>2</sup> (gCO <sub>2</sub> /kWh)	National CO <sub>2</sub> emissions 1998 <sup>3</sup> (Mt)	CO <sub>2</sub> from standby power (Mt)	Standby as % of national CO <sub>2</sub> (%)
Bulgaria*	2.96 <sup>4</sup>	33	98	0.86	32.47	2.6	419	48.60	0.4	0.8
Romania*	7.4	14	104	0.91	47.43	2.0	304	94.59	0.3	0.3
Hungary*	3.85	30	116	1.01	33.01	3.0	362	57.42	0.4	0.7
Germany	36.03	44	1585	13.9	527	2.6	690	884	9.6	1.1
Australia	7.09	87	617	5.4	171	3.2	942	306	5.1	1.7
Poland	11.8	20	236	2.1	124	1.7	921	350	1.9	0.5
OECD	386	38	14,634	128	8362	1.5	530	12,235	68	0.6

Source: IEA 2001 (with amendments)

\* Results from the present study

<sup>1</sup> Data source: IEA 2000

<sup>2</sup> Electricity emission factor. Data source: Thomas *et al.* 2000

<sup>3</sup> Data source: IEA 2000

<sup>4</sup> Data source: BNSI 1992




# Household expenditure for standby power (per household and country)

	Price (USD/ kWh)	Household expenditure (USD/year)	Total household standby power cost (million USD/year)
Bulgaria	0.04	11.6	34
Romania	0.04	4.9	36
Hungary	0.08	21.0	81

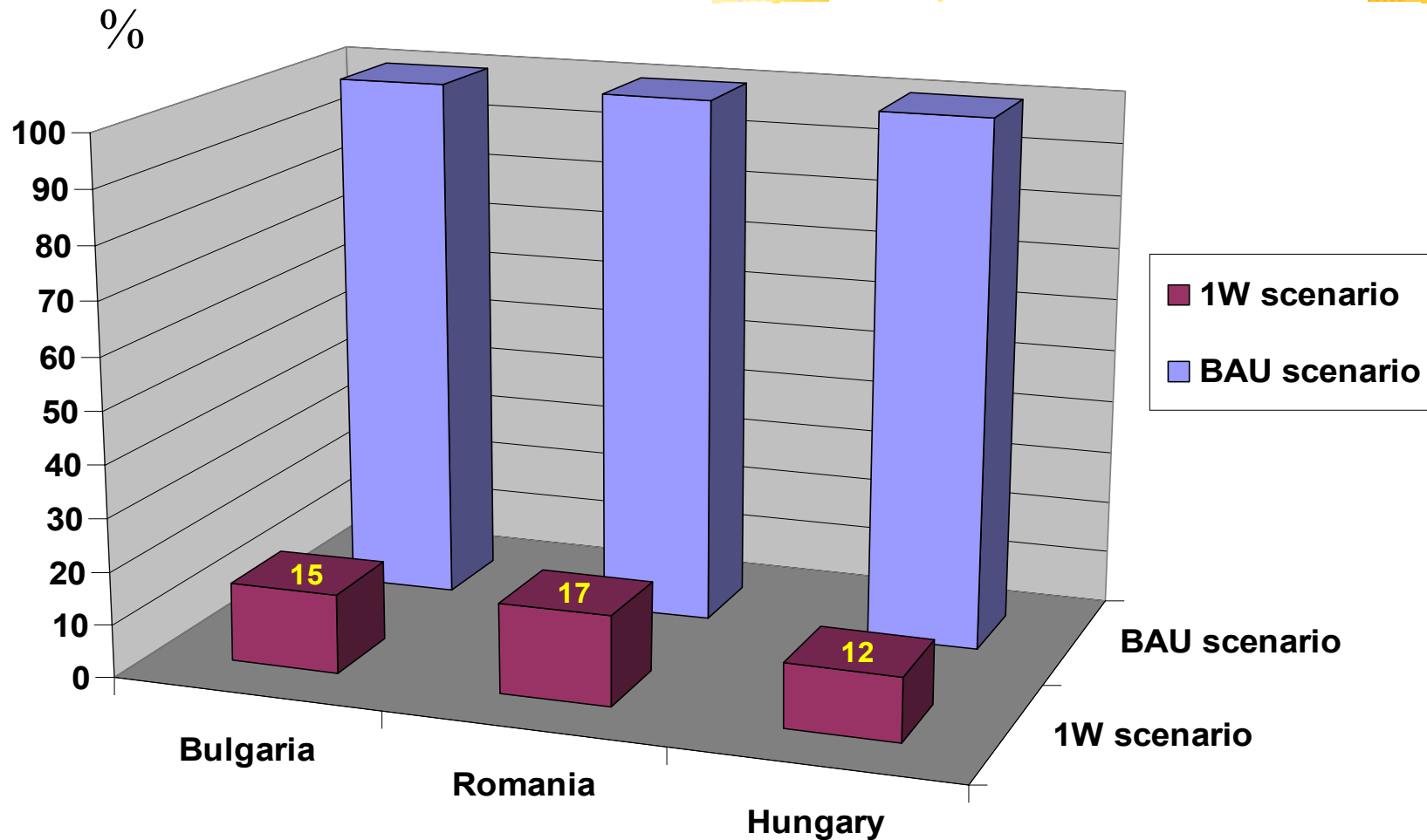
- Electricity price for household is 0.07 leva/kWh in Bulgaria (December 2001)
- Electricity prices for households is 1200 Lei/kWh in Romania (July 2001)
- Electricity prices for households is 23 Forint/kWh in Hungary (December 2001)

# Reduction of residential standby power consumption and CO<sub>2</sub> emissions after implementing the **1 Watt** plan



Country	Total annual standby power of HH (TWh/yr)	Average standby power per HH (W)	Average daily standby consumption per HH (Wh/d)	Total standby power saved (TWh/yr)	Total CO <sub>2</sub> emissions saved (Mt)
Bulgaria	0.13	5	120	0.73	0.30
Romania	0.16	2.3	56	0.75	0.24
Hungary	0.12	3.5	84	0.89	0.30

# Reduction of residential standby power in case of implementation of **1W** plan



## Comparison to previous estimates for Hungary (IEA 2000)

Estimation	Average standby power (W/home)	Total standby power demand (MW)	Total standby energy (TWh/yr)	Standby as % of national electricity (%)	CO <sub>2</sub> emission ratio (gCO <sub>2</sub> /kWh)	National CO <sub>2</sub> emissions 1998 (Mt)	CO <sub>2</sub> from standby power (Mt)	Standby as % of national CO <sub>2</sub> (%)
<b>Authors'</b>	<b>30</b>	<b>116</b>	<b>0.99</b>	<b>3.0</b>	<b>624</b>	<b>57.42</b>	<b>0.6</b>	<b>1</b>
IEA	20	77	0.7	2.0	624	58	0.4	0.7

- ⌘ Average standby power per HH is **50%** more than IEA estimation
- ⌘ CO<sub>2</sub> emissions from residential standby power consumption are **50%** more than IEA estimation

# Conclusions



- ⌘ The scale of standby power losses in CEE countries is significant
- ⌘ There is a clear need of broader studies on CEE region
- ⌘ After implementation of 1W standby power policy, standby power consumption and related CO<sub>2</sub> emissions can drop by 80 - 90%
- ⌘ Savings potentials are:
  - Bg: 0.3 Mt of CO<sub>2</sub>                      and                      USD 29 million
  - Ro: 0.24 Mt of CO<sub>2</sub>                      and                      USD 30 million
  - Hu: 0.3 Mt of CO<sub>2</sub>                      and                      USD 72 million.

# Acknowledgements



⌘ Benoit Lebot, International Energy Agency

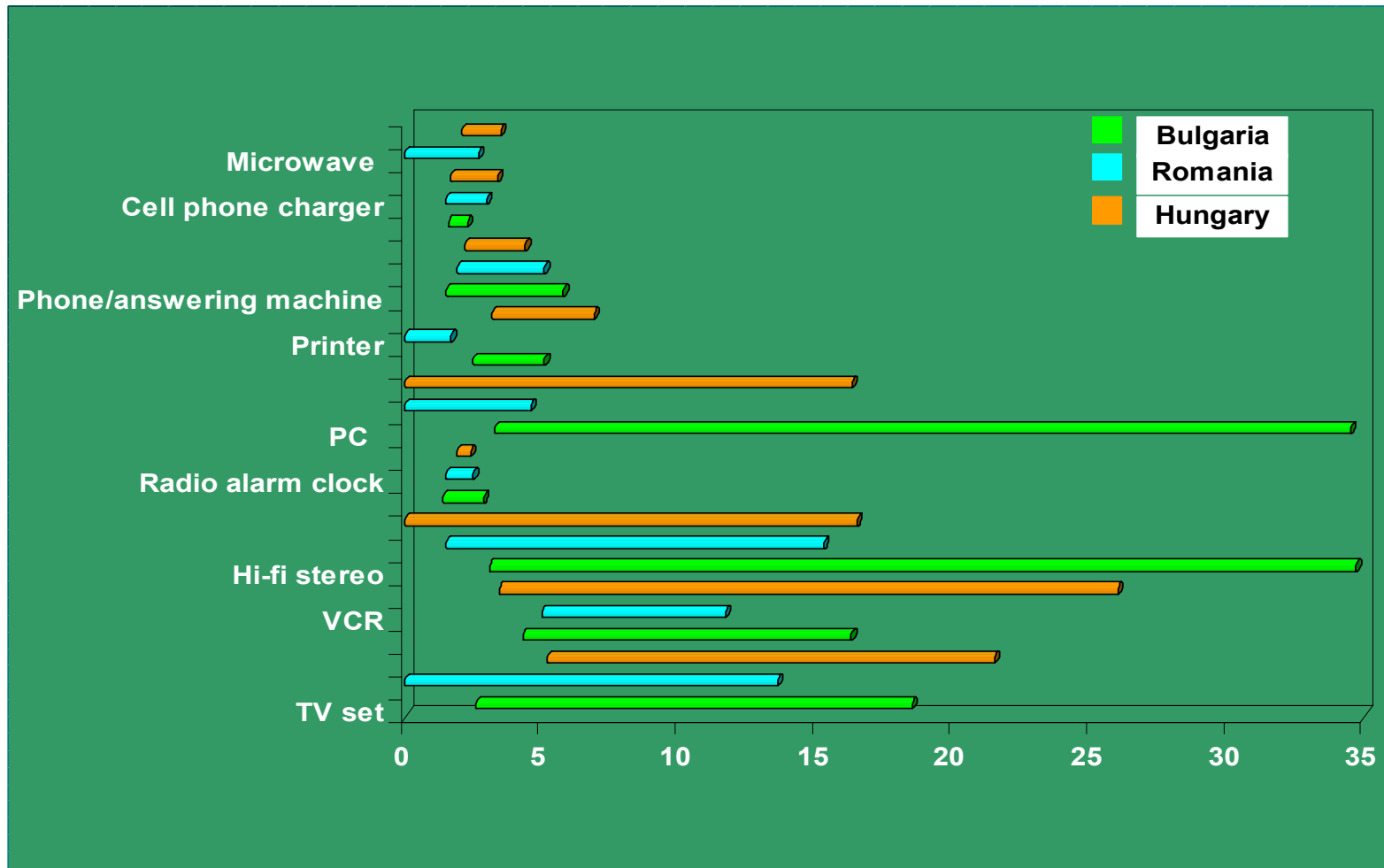
⌘ Peter Karbo, Danish Electric Utilities



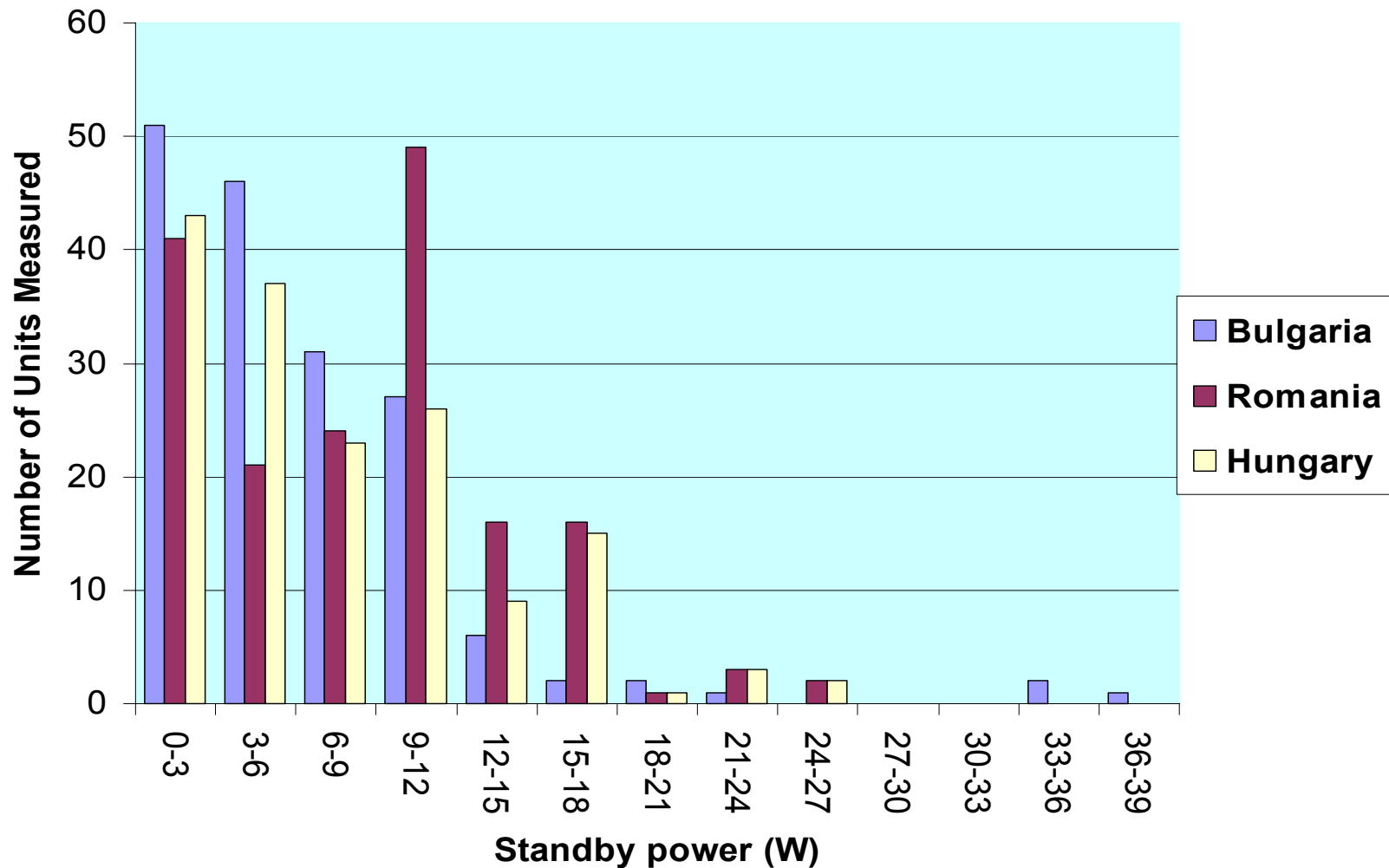
## Standby power consumption of appliances in Bulgarian, Romanian and Hungarian households

Appliance	Bulgaria			Romania			Hungary		
	Number of appliances measured	Average number of appliances in HH	Average standby consum (Wh/d)	Number of appliances measured	Average number of appliances in HH	Average standby consum (Wh/d)	Number of appliances measured	Average number of appliances in HH	Average standby consum (Wh/d)
Video									
TV set	39	1.30	173	46	1.53	103	38	0.97	215
VCR	23	0.77	170	12	0.40	199	20	0.51	217
Audio									
Hi-fi stereo	18	0.60	204	5	0.17	175	20	0.51	194
Tape recorder	11	0.37	57				4	0.10	45
Radio alarm clock	7	0.23	48	11	0.37	48	5	0.13	46
IT									
PC	8	0.27	177	9	0.30	61	21	0.54	203
Printer	3	0.10	90	3	0.10	27	3	0.13	61
Communication									
Phone/answering machine	19	0.63	77	4	0.13	71	11	0.28	102
Cell phone charger	4	0.13	43	5	0.17	18	5	0.13	50
Kitchen products									
Microwave				3	0.10	21	10	0.26	55
Kitchen oven	3	0.10	37						
Miscellaneous									
Extension cord	7	0.23	38				8	0.21	67
Total	142	4.73	1114	98	3.27	723	145	3.77	1255

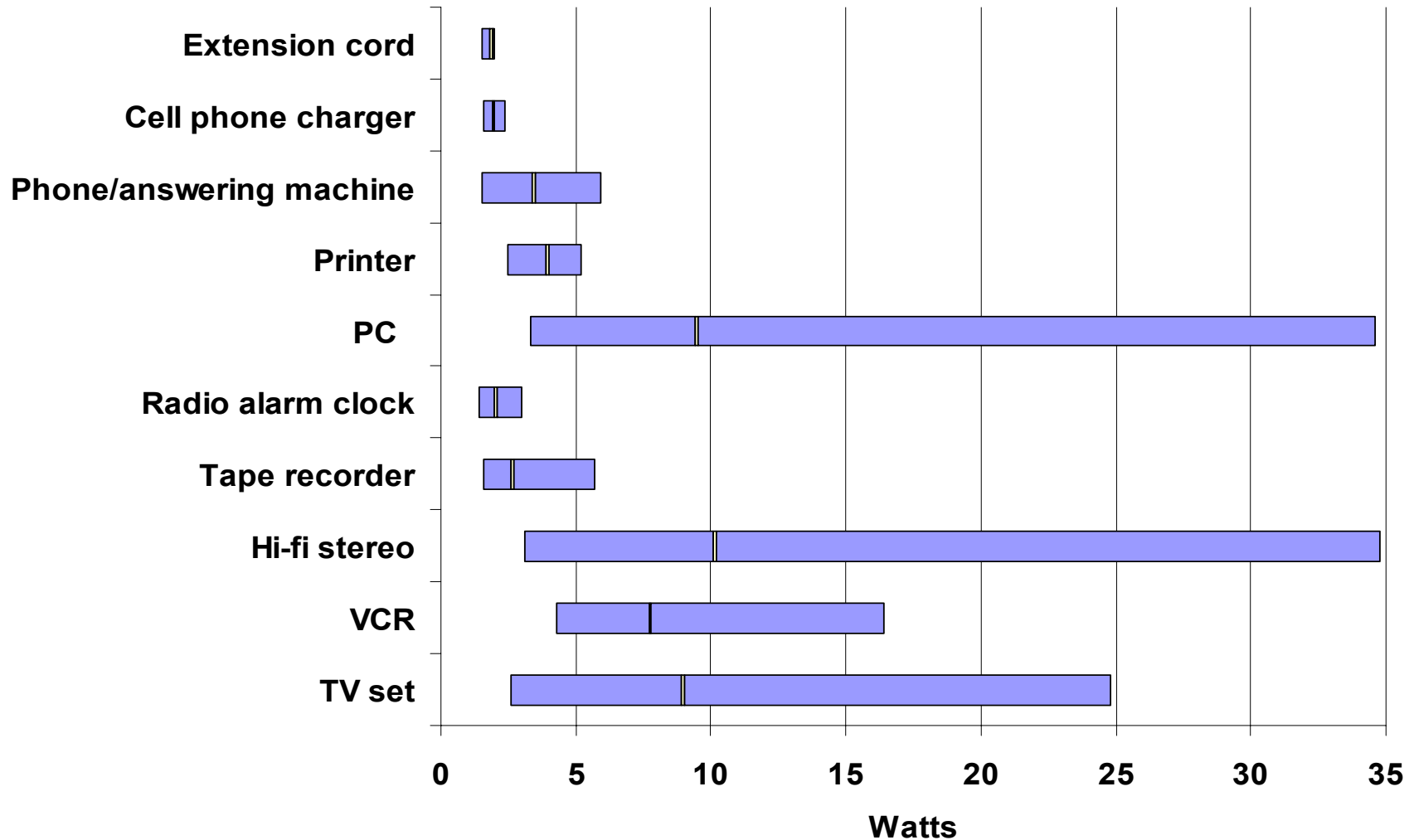
# Standby power ranges (minimum and maximum) of appliance types in the studied countries



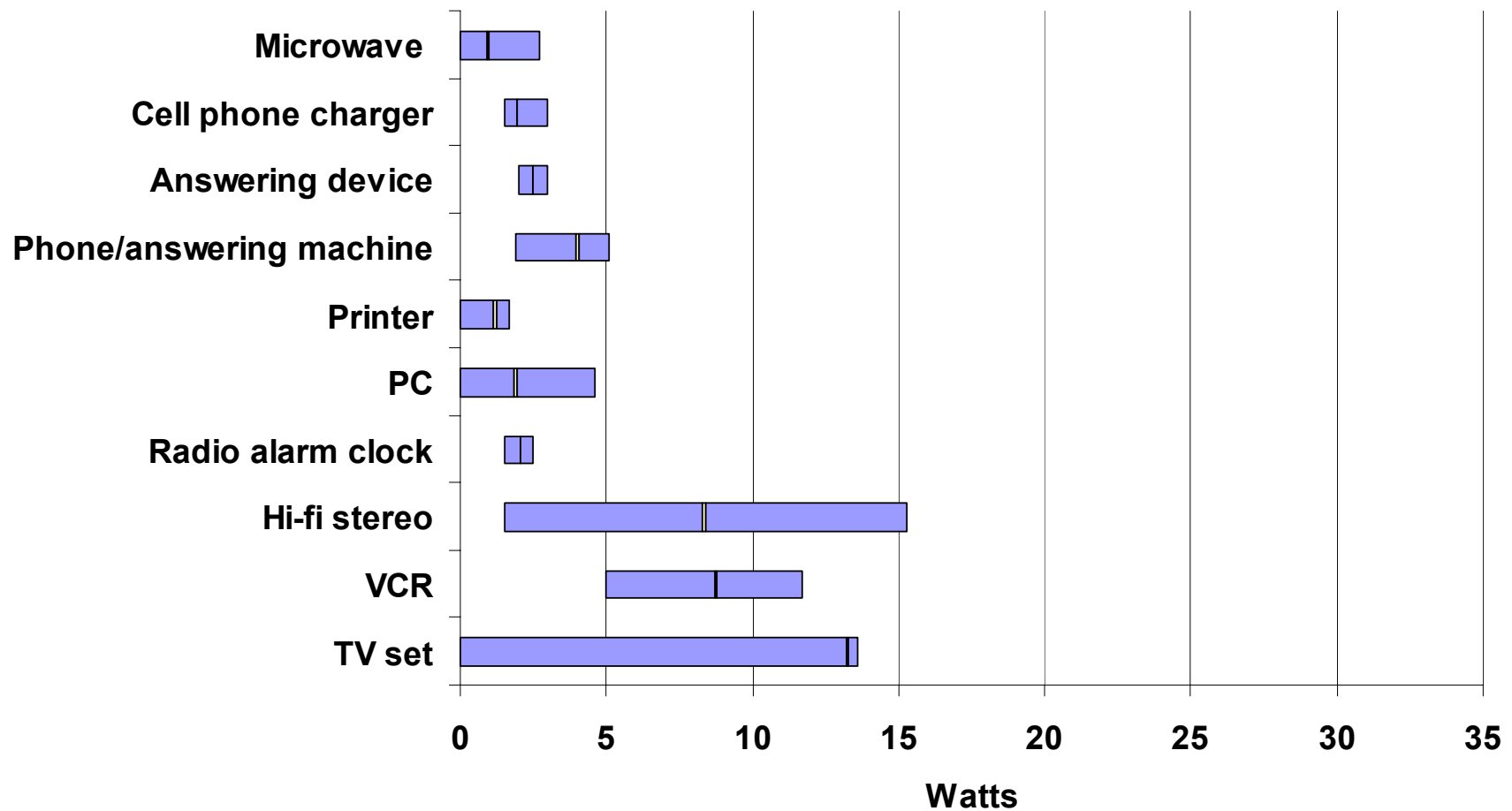
# Distribution of appliance standby power in Bulgaria, Romania and Hungary



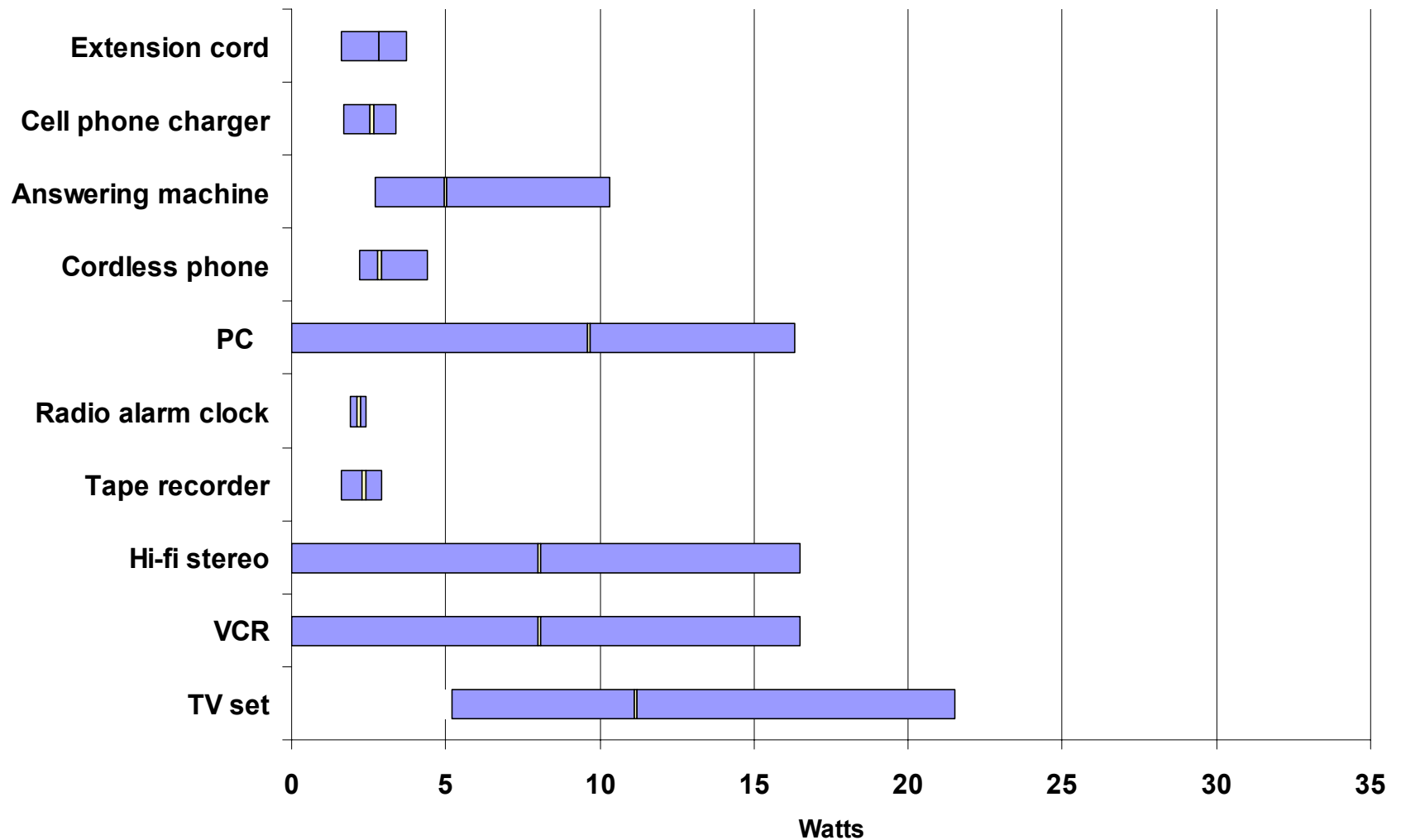
# Appliances standby ranges, Bulgaria



# Appliances standby ranges, Romania



# Appliances standby power ranges, Hungary





# CEE standby consumption in an international context

Country	Number of HH (millions of units)	Average standby power (W/HH)	Annual standby Electr. Use (KWh/yr)	Fraction of total resid. Elec. Use (%)	Total standby power demand (MW)	Standby as % of national electricity (%)	CO <sub>2</sub> from standby power (Mt)	Standby as % of national CO <sub>2</sub> (%)
<i>Bulgaria</i>	<i>2.96</i>	<i>33</i>	<i>288</i>	<i>N/a</i>	<i>98</i>	<i>2.6</i>	<i>0.4</i>	<i>0.8</i>
<i>Romania</i>	<i>7.4</i>	<i>14</i>	<i>154</i>	<i>7.3</i>	<i>104</i>	<i>2.0</i>	<i>0.3</i>	<i>0.3</i>
<i>Hungary</i>	<i>3.85</i>	<i>30</i>	<i>259</i>	<i>11.5</i>	<i>116</i>	<i>3.0</i>	<i>0.4</i>	<i>0.7</i>
Germany	36.03	44	389	10	1585	2.6	9.6	1.1
Australia	7.09	87	527	13	617	3.2	5.1	1.7
Japan	41.2	46	530	12	1,903	1.7	7.3	0.6
USA	101.4	50	440	5	5.052	1.3	28.7	0.5
OECD	386	38	332	N/a	14,634	1.5	68	0.6

*Sources of comparative data: Lebot et al. 2000, IEA 2000b, IEA 2001, BNSI 1992, KSH 2001, Thomas et al. 2000*